<u>In the Claims</u>:

Please rewrite the claims as set forth in Exhibit A attached hereto, a "redlined" copy of the original claims in which added material is <u>underlined</u> and deleted material has been ~~striken out~~. Exhibit B attached hereto is a "clean" copy of all pending claims as they stand amended to date.

REMARKS

Under the Office Action of October 25, 2002, claims 1-21 were subject to examination. Of those claims, claims 1-8, 11, 12, 15-17, and 19-21 were rejected under the provisions of 35 USC §103 as discussed more particularly below. Claims 9, 10, 13, 14 and 18 were found objectionable, but otherwise allowable, if rewritten in independent form incorporating all limitations of their base and any intervening claims.

It is also noted that the declaration was considered defective because the citizenship of one of the inventors, Daniel J. Braunstein, was not identified.

With this response, claims 1, 15, 20 have been rewritten, and new claims 22-26 have been added. New claim 22 is a combination of original claims 1, 4, and 9 written in independent form; new claim 23 is identical in content to original claim 10 but depends from new claim 22; new claim 24 is a combination of original claims 1, 12 and 13 written in independent form; new claim 25 is identical in content to original claim 14 but depends from new claim 24; and new claim 26 is a combination of original claims 1 and 18 written in independent form.

All of the new claims should be in condition for immediate allowance since they claims were found only objectionable but otherwise allowable if rewritten in independent form.

A new declaration executed by Mr. Braunstein is enclosed to correct the defective declaration as set forth in the Action.

The remainder of the claims have been amended for purposes of refining the definition of the invention and to more particularly point out what the applicants regard as their invention. Therefore, the amendments should not be construed as an

admission of the correctness of the rejections because the applicant's do not believe that the basis for the rejections was appropriate. They do believe, however, that the claims now before the Office should be allowed in the scope presented because they define patentable subject matter that represents a significant departure from the teachings of the art. As will be apparent, there are a number of fundamental reasons why the rejections of the original claims were inappropriate and why it would be incorrect to reject the amended and new claims on similar grounds.

Under the Office Action, claims 1-7, 11-12, 15-17, and 20-21 were rejected under 35 USC §103 as unpatentable over Bille (5,062,702) in view of Bille (5,920,373); the Office Action having taken the fundamental position that Bille '702 shows substantially all of the features of the claimed invention except for the support, which is believed to be inherent since Bille '702 deals with measurement of the human eye supported in the normal way, and the "controllable positioning of the output beam", which is believed to have been provided by Bille '373 since it discloses a focus control. For reasons set forth below Applicant's respectfully traverse these rejections.

The Present Invention

The invention comprises a system and method for automatically performing dynamic screen testing on a surface and determining its shape from which other optical parameters of interest may be derived and reported. A measuring head, consisting of a source, beamsplitter, objective lens, and lens array with a CCD camera, is mounted on a translation stage and moves along the optic axis of the head relative to the part under test. The part under test is mounted on an appropriate support, such as a three-point support nest, that automatically centers spherical parts on the optical axis of the system.

Light is projected along the optical axis through a microscope objective or other appropriate lens to illuminate the part under test with a predetermined wavefront, preferably spherical, so that subsequent calculations are made simpler if this light is recollimated parallel to the optical axis of the system. Light reflected from the part under test passes back through the lens, after which it passes through a pellicle or

cube beamsplitter towards a CCD camera. A two-dimensional array, preferably in the form of a pair of crossed lenticular screens, is placed in front of the CCD active area so that a series of sharp images are formed on the CCD array. When the system measuring head is positioned so that the focal point of the objective is located near the surface of the part under test, or near its center of curvature, the incoming nearly parallel light produces a series of spots on the CCD active area. The shifts in the pattern of spots are used to determine the shape of the surface under test. Mathematical analysis of this shape provides information on the radius of curvature of the part (if spherical), the "Spherical" and "Cylindrical" radii of curvature of a toric part (along with the angle between the major axes and a given reference axis), and the "Shape Factor" of an aspheric part. For ease of interpretation, the overall shape can be expressed in various ways, including Zernike polynomials. Software performs this analysis and facilitates providing results in many useful forms – contour plots, wire-frame models of deviation, direct readout of coefficients, direct readout of RMS surface form, direct readout of peak-to-valley difference, etc. Display screens are customizable for the engineering specialist or on-the-floor auditing and measurement for production. Custom processing capabilities are available using Visual Basic® and an Object Linking And Embedding (OLE®) interface.

35 USC §103 Rejection

It must be kept in mind that for a proper rejection under 35 USC 103, it first must be determined whether a prima facie case for obviousness exists. In determining whether such a case exists, it is necessary to show that the prior art teachings are sufficient to have ***suggested*** making the claimed modifications to one of ordinary skill in the art; the prior art ***and not the Applicant's teachings*** must provide one of ordinary skill in the art the motivation to make the proposed modification. See, for example, In re Lalu, 747 F.2d 703, 223 USPQ 1257, 1258 (Fed. Cir. 1984). Cf. Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988) ("Something in the prior art as a whole must suggest the desirability and thus the obviousness, of making the combination.")

With respect to further case law regarding the kind of suggestiveness required see also:

In re Laskowski, 871 F.2d 115, 10 USPQ 2d 1397 (Fed. Cir. 1989)

> "Although the Commissioner suggests that [the structure in the primary prior art reference] could readily be modified to form the [claimed] structure, "[t]he mere fact that the prior art reference could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." "

Northern Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 15 USPQ2d 1321 (Fed. Cir. 1990)

> "It is insufficient that the prior art disclosed the components of the patented device, either separately or used in other combinations; there must be some teaching, suggestion, or incentive to make the combination made by the inventor."

Nor may the applicant's own teachings be used to piece together the claimed invention from the prior art references. See, for example,

In re Gorman, 933 F.2d 982, 18 USPQ2d 1885 (Fed. Cir. 1991)

> "As in all determinations under 35 U.S.C. section 103, the decision maker must bring judgment to bear. It is impermissible, however, simply to engage in a hindsight reconstruction of the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps."

In re Fitch, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992)

> "[I]t is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious ... This court has previously stated that "[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." "

Texas Instruments Inc. v. U.S. Int'l Trade Common, 988 F.2d 1165, 26 USPQ2d 1018 (Fed. Cir. 1993)

> "The prior art references in combination do not suggest the invention as a whole claimed in the ... patent. Absent such a suggestion to combine

> the references, respondents can do no more than piece the invention together using the patented invention as a template."

Moreover, where the art teaches away from what the applicant advocates, this is a strong indication of patentability as set forth in, for example,

Kloster Speedsteel AB v. Crucible, Inc., 793 F.2d 1565, 230 USPQ 81 (Fed. Cir. 1986), *on rehearing,* 231 USPQ 160 (Fed. Cir. 1986)

> "That the inventor achieved the claimed invention by doing what those skilled in the art suggested should not be done is a fact strongly probative of nonobviousness."

Gillette Co. v. S.C. Johnson & Son, Inc., 919 F.2d 720, 16 USPQ2d 1923 (Fed. Cir. 1990)

> "The closest prior art reference "would likely *discourage* the art worker form attempting the substitution suggested by [the inventor/patentee]."

The Bille '702 patent shows and describes a purely static system for mapping the topography of the cornea of an eye supported in the usual rather dynamic way within the head of its owner. The present invention, as previously and presently claimed, is a dynamic system in which a wavefront of predetermined shape is made to axially scan a test surface to be measured by being translated relative to that test surface such that the wavefront is returned in a distorted condition whose shape varies in accordance with, not only the topography of the test surface, but the relative axial positions of the test surface and the wavefront. It should be noted that, unlike the inherent support of Bille '702, the test surface of the invention preferably does not move with respect to its support. As the wavefront is made to axially scan the test surface, the distorted wavefront, which is changing as scanning takes place, is sampled at different axial locations, and the resultant data is analyzed in accordance with the mathematical schemes set forth in analytical detail in the specification. As explained in the specification, e.g., page 22, lines 6-11, this is done to reduce random errors in measurement and thus obtain a more accurate description of the test surface than otherwise is attainable by measuring at only one position, as advocated by Bille

'703. There is nothing in Bille '703 to suggest such scanning, which is believed to have been set forth in the claims as originally submitted, but even more so now with the claims as rewritten.

Bille '373, a system for mapping corneal topography, is described as having a "Z-tracker unit" whose purpose is to restore focus should a patient move. It also suggests a refinement that compensates measurements for patient heartbeat and respiration induced changes in measurements. However, this is not the claimed axial scanning of the claimed invention. Indeed, the refocusing of Bille '373 clearly demands that wavefront sampling be made in a single plane, and not at several planes along a scanning axis. Therefore, Bille '373 physically could not modify Bille '703 to arrive at the claimed invention.

The notion in the Action that a computer may be employed to conduct mathematical analysis begs the question of whether or not the computer of '373 actually conducts the analysis called for in claims 2, 3, and 17. What is at issue is not if a computer can be used, but what algorithms are being employed for what purpose. Applicant's believe that the computer of Bille cannot be performing the same analysis of the invention since both claims call for the calculation of values of coefficients based on the local deformation of the wavefront "at at least one position" of the source with respect to the test surface. This means that the coefficients of this invention are evaluated at every sampling position along the sampling axis, and it is these coefficients that are used in the "optimization" that is called for in claim 3. There is nothing in either Bille reference comparable to this since each Bille, which make measurements in only one plane, has no out of plane data to optimize in the first place.

The comments of the action relating to the rejections of the remainder of the claims are moot since the rejections of the claims from which they depend are legally and factually faulty and should be withdrawn.

In view of the foregoing response, it is believed that this application is in condition for allowance and favorable action to that effect is earnestly solicited. If there are any questions regarding any aspect of this response, the Examiner should feel free to contact Applicants' attorney at the telephone number listed below.

Respectfully submitted,

March 14, 2002
Date

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Enclosures

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1. (Amended Once) Apparatus for automatically measuring the surface properties of optical elements, said apparatus comprising:

a support for an element having at least one test surface to be measured;

means for generating an output beam having a predetermined wavefront profile;

means for controllably ~~positioning~~ translating said output beam along an optic axis with respect to said support so that said predetermined wavefront profile thereof impinges on said element from a predetermined direction and then is reflected to travel opposite said predetermined direction as a distorted wavefront containing distortions that vary in accordance with the topography of said test surface and the position of said output beam along said optic axis; and

means for sampling said distorted wavefront profile at predetermined locations thereover as said output beam is ~~moved~~ translated relative to said test surface and determining the local deformation of said wavefront everywhere corresponding to a sampled location on said test surface and the position of said output beam with respect to said test surface along said optic axis.

2. The apparatus of claim 1 further including analytical means for representing the topography of said test surface with a mathematical approximation comprising a series of coefficients and variables; calculating the value of said coefficients based on the local deformation of said wavefront at at least one position of said source with respect to said test surface.

3. The apparatus of claim 2 wherein said analytical means includes means for performing an optimization analysis using the values of said coefficients calculated for each position of said source and test surface to arrive at a final value for said coefficients that are used for said mathematical approximation to represent the shape of said surface to a predetermined accuracy.

4. The apparatus of claim 1 wherein said predetermined wavefront comprises a plane wavefront.

5. The apparatus of claim 1 wherein said predetermined wavefront comprises a nominally spherical wavefront.

6. The apparatus of claim 1 wherein said means for generating said output beam comprises a light source and collimating optics.

7. The apparatus of claim 6 further including a well-corrected objective lens.

8. The apparatus of claim 1 further including a positive lens located in a fixed position with respect to said support and along said predetermined direction to facilitate the measurement of parts having long radii of curvature.

9. The apparatus of claim 4 further including a reflective means positioned with respect to said support to facilitate the measurement of transmitted wavefront errors in optical bandpass components including filters and windows.

10. The apparatus of claim 9 further including a relay section.

11. The apparatus of claim 4 further including a beam expansion section.

12. The apparatus of claim 1 wherein said means for sampling said distorted wavefront comprises a two-dimensional lens array and a two-dimensional photodetector array having discrete sensing elements.

13. The apparatus of claim 12 wherein said two-dimensional lens array comprises a pair of crossed lenticular screens with index mismatching material between them.

14. The apparatus of claim 12 wherein said means for generating said output beam comprises a microscope objective lens and further including a telescopic section between said microscope objective lens and said two-dimensional lens array to image said two-dimensional photodetector array into the pupil of said microscope objective lens.

15. (Amended Once) Apparatus for automatically measuring the properties of surfaces that are at least partially specularly reflective, said apparatus comprising:

a support for an element having at least one test surface to be measured;

a source having an output with a predetermined wavefront profile;

means for controllably moving said source and said support relative to one another along an optic axis so that a test surface in said support continuously reflects said output from said source back towards said source while distorting said wavefront profile thereof in accordance with the topography of said test surface and the relative position of said source with respect to said test surface along said optic axis; and

means for sampling said distorted wavefront profile at predetermined locations thereover as said source is moved relative to said test surface along said optic axis and determining the local deformation of said wavefront everywhere corresponding to a sampled location on said test surface and the position of said source with respect to said test surface along said optic axis.

16. The apparatus of claim 15 further including analytical means for representing the topography of said test surface with a mathematical approximation comprising a series of coefficients and variables; calculating the value of said coefficients based on the local deformation of said wavefront at at least one position of said source with respect to said test surface.

17. The apparatus of claim 15 wherein said analytical means includes means for performing an optimization analysis using the values of said coefficients calculated for each position of said source and test surface to arrive at a final value for said coefficients that are used for said mathematical approximation to represent the shape of said surface to a predetermined accuracy.

18. The apparatus of claim 1 wherein said means for sampling said distorted wavefront profile comprises a two-dimensional lenslet array having a focal plane and a one-dimensional photodetector array arranged to scan across said focal plane.

19. The apparatus of claim 1 wherein said means for generating an output beam comprises one of a pulsed light source or strobe.

20. (Amended Once) A method for automatically measuring the surface properties of optical elements, said method comprising the steps of:

supporting an element having at least one test surface to be measured;

generating an output beam having a predetermined wavefront profile;

controllably ~~positioning~~ translating said output beam with respect to said support along an optic axis so that said predetermined wavefront profile thereof impinges on said element from a predetermined direction and then is reflected to travel opposite said predetermined direction as a distorted wavefront containing distortions that vary in accordance with the topography of said test surface and the position of said output beam along said optic axis; and

sampling said distorted wavefront profile at predetermined locations thereover as said output beam is moved relative to said test surface along said optic axis and determining the local deformation of said wavefront everywhere corresponding to a sampled location on the test surface and the position of said output beam with respect to said test surface along said optic axis.

21. The method of claim 20 further including the step of analytically representing the topography of said test surface with a mathematical approximation comprising a series of coefficients and variables and calculating the value of said coefficients based on the local deformation of said wavefront at at least one position of said source with respect to said test surface.

--22. (NEW) Apparatus for automatically measuring the surface properties of optical elements, said apparatus comprising:

a support for an element having at least one test surface to be measured;

means for generating an output beam having a predetermined plane wavefront profile;

means for controllably positioning said output beam with respect to said support so that said predetermined wavefront profile thereof impinges on said element from a predetermined direction and then is reflected to travel opposite said predetermined direction as a distorted wavefront containing distortions that vary in accordance with the topography of said test surface and the position of said output beam;

means for sampling said distorted wavefront profile at predetermined locations thereover as said output beam is moved relative to said test surface and determining the local deformation of said wavefront everywhere corresponding to a sampled location and the position of said output beam with respect to said test surface; and

reflective means positioned with respect to said support to facilitate the measurement of transmitted wavefront errors in optical bandpass components including filters and windows.--

--23. (New) The apparatus of claim 22 further including a relay section.--

--24. (New) Apparatus for automatically measuring the surface properties of optical elements, said apparatus comprising:

a support for an element having at least one test surface to be measured;

means for generating an output beam having a predetermined wavefront profile;

means for controllably positioning said output beam with respect to said support so that said predetermined wavefront profile thereof impinges on said element from a predetermined direction and then is reflected to travel opposite said predetermined direction as a distorted wavefront containing distortions that vary in accordance with the topography of said test surface and the position of said output beam; and

a two-dimensional lens array comprising a pair of crossed lenticular screens with index mismatching material between them.and a two-dimensional photodetector array having discrete sensing elements for sampling said distorted wavefront profile at predetermined locations thereover as said output beam is moved relative to said test surface and determining the local deformation of said wavefront everywhere corresponding to a sampled location and the position of said output beam with respect to said test surface.--

--25. (New) The apparatus of claim 24 wherein said means for generating said output beam comprises a microscope objective lens and further including a telescopic section between said microscope objective lens and said two-dimensional

lens array to image said two-dimensional photodetector array into the pupil of said microscope objective lens.--

--26. (New) Apparatus for automatically measuring the surface properties of optical elements, said apparatus comprising:

a support for an element having at least one test surface to be measured;

means for generating an output beam having a predetermined wavefront profile;

means for controllably positioning said output beam with respect to said support so that said predetermined wavefront profile thereof impinges on said element from a predetermined direction and then is reflected to travel opposite said predetermined direction as a distorted wavefront containing distortions that vary in accordance with the topography of said test surface and the position of said output beam; and

means for sampling said distorted wavefront profile at predetermined locations thereover as said output beam is moved relative to said test surface and determining the local deformation of said wavefront everywhere corresponding to a sampled location and the position of said output beam with respect to said test surface, said means for sampling said distorted wavefront profile comprising a two-dimensional lenslet array having a focal plane and a one-dimensional photodetector array arranged to scan across said focal plane.--